# 3.3 Support For Resource Conservation and Recovery Act Metal, Forensic Geophysics, and Air Stream Characterization

## Technology Need

TASK 1: DIAL requires access to a viable test train and support in test implementation, test analysis, and operational coordination.

TASK 2: MACTEC requires support in field activities such as instrument position. In addition, support in test implementation, test analysis, operational coordination, and reporting is required.

TASK 3: The Center for Process Analytical Chemistry (CPAC) requires access to a viable test train with classical analysis, supports for comparison with results by the flow probe unit. CPAC also requires support in test implementation, test analysis, and operational coordination.

## Technology Description

TASK 1: DIAL will use their Fourier Transform Infrared Spectroscopy (FTIR) equipment to measure and verify the performance of the Thermatrix flameless oxidizer. The FTIR method to be used is based on the absorption or emission of infrared radiation as a molecule undergoes a transition from one vibrational-rotational level to another. FTIR is a monitoring device that has the ability to detect organic molecules and break down products that may be precursors to dioxin formation.

DIAL will also employ their LIBS equipment to measure and verify the performance of the Pall ceramic filter. LIBS is a laser-based diagnostic technique for measuring the concentration of toxic metals in the offgas emission from various waste treatment facilities. The LIBS produces a pulsed laser beam that is focused at the test point and produces a spark due to the high-energy density at the laser pulse. The spark generates a plasma that excites various atomic elements present in the focal volume. The atomic emission from the plasma is collected with a collimating lens and sent to the detection system. Wavelength positions of the emission lines are used to identify the atomic species present. Likewise, the intensity of the atomic emission lines observed in the LIBS spectrum are then used to infer the concentration of the atomic species.

TASK 2: Ground penetrating radar (GPR) is a remote sensing geophysical technique for mapping subsurface soils, groundwater, and hydrocarbon plumes, and for locating buried objects such as tanks, pipes, and electrical utilities. The GPR system consists of an antenna, a processing console, a graphic display recorder, and an optional magnetic recorder.

TASK 3: The Flow Probe Chemical Analyzer is an in situ generic chemical speciating technology that measures chemicals in both liquid and gas states for field survey applications, as well as process control and monitoring applications. Applications for this technology are the same as those that use reagent-based, optical absorption spectroscopy. The analyzer was designed to be an in situ generic platform for performing wet chemistry-based analyses in field survey applications and process control and monitoring applications.

## Benefits

TASK 1: The FTIR system has potential of providing a real-time ability to detect organic molecules and breakdown products that may be precursors to dioxin formation. The LIBS systems has potential of providing real-time measurement of toxic metals in the thermal treatment offgas stream.

TASK 2: The GPR systems will provide rapid assessment of site conditions using noninvasive remote sensing techniques. Data provided by the GPR may improve the success of more standard techniques such as drilling and sampling by allowing specific target areas to be drilled or sampled. GPR can be used to: (1) find buried objects, (2) map subsurface sediments, bedrock, and groundwater, (3) locate areas of contaminated sediments and leachate plumes, (4) identify and map fracture zones, cavities, and voids, and (5) determine the engineering properties of soils and rock, including rippability.

TASK 3: The Flow Probe Chemical Analyzer has the advantage of well characterized reagent chemistry and optical spectroscopy as its detection mechanism. The sensor size is small, with a small analysis volume and a high detection sensitivity (a few parts per billion for many analytes). The analyzer is very efficient, allowing many analyses to be conducted before reagent replenishment and waste extraction.

## Collaboration/Technology Transfer

Potential users of these technologies are widespread across the DOE complex and the nation. Because the need is extensive, the technologies should be readily transferable to private and public entities. Developments from the evaluations will result in dissemination of technical and economic information via presentations and/or publications at national meetings, conferences, workshops, seminars, etc.

TASK 1: The major collaborator on this effort is DIAL. Both the LIBS and the FTIR have applicability in the government and private industry.

TASK 2: The major collaborator on this effort is MACTEC. GPR has applicability in both government and private industry.

TASK 3: The major collaborator on this effort is CPAC. The Flow Probe Chemical Analyzer has applicability in both government and private sampling schemes.

## Accomplishments

The 1995 project was called RCRA and Other Heavy Metals in Soils Demonstration. The purpose of this demonstration was to evaluate the performance of field transportable technologies in the identification and quantification of RCRA and other heavy metals in soils. The primary goals accomplished for this demonstration were: (1) selected and characterized two demonstration sites, (2) selected technologies for the demonstration, (3) verified developer claims regarding technology performance, (4) compared field instrument performance to conventional Environmental Protection Agency approved laboratory analytical methods and protocols, (5) determined the logistical and economic resources required to operate each technology demonstrated; and (6) prepared a final report.

## TTP Information

Support For RCRA Metal, Forensic Geophysics, and Air Stream Characterization technology development activities are funded under the following technical task plan (TTP):

TTP No. PE15C241 "Support For RCRA Metal, Forensic Geophysics, and Air Stream Characterization"

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## Bibliography of Key Publications

None available at this time.